Conference Reports: The Seventh International Conference on EcoBalance

Designing Our Future Society Using Systems Thinking
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Introduction

The Seventh International Conference on EcoBalance (the 7th ICEB) was held at the International Conference Center 'Epochal' in Tsukuba, Japan on November 14th–16th, 2006, and was sponsored by:

– The Institute of Life Cycle Assessment, Japan
– The Society of Non-Traditional Technology
– National Institute for Agro-Environmental Sciences
– Japan Environmental Management Association for Industry
– Institute for Building Environment and Energy Conservation
– Center for Environmental Information Science

The 7th ICEB attracted 366 participants with a good balance of researchers, academia, industrial professionals, and consultants. The 79 foreign participants came from 20 countries; the largest delegation consisting of 14 people came from Korea, followed by Germany, Italy, Switzerland, Taiwan, USA, Australia, Sweden, China, France, Belgium, Brazil, Canada, Denmark, India, The Netherlands, Norway, Romania and Thailand.

The International Conference on EcoBalance began in 1994, originally addressing 'Life Cycle Assessment (LCA)'. After that, the Conference has developed as a platform for discussion concerning the development and applications of tools for sustainability assessment based on 'System Thinking.' Considering such a history of the Conference, the main theme of the 7th ICEB was set as 'Designing Our Future Society Using Systems Thinking'.

The 7th ICEB had 146 platform and 94 poster presentations, which covered a variety of subjects ranging from methodologies such as LCA, Eco-efficiency, Input-Output Analysis (IOA), and Environmental Accounting to applications in the fields of buildings, cars, electronic equipment and agriculture, etc. The 240 presentations were distributed in the plenary session, 5 special platform sessions, 15 regular platform sessions, and the poster session (**Table 1**).

A characteristic of the program in The 7th ICEB was to organize five special sessions concentrating on specific sub-

Table 1: Sessions and the number of presentations in the 7th ICEB

Sessions		Number of Presentations
Opening Plenary Session		2
Special Platform Sessions	Energy and Sustainability	12
	Eco-Industrial Development	7
	Eco-Efficiency for Information and Communication Technology	7
	Flow Management for Process Innovation and Sustainability	5
	Waste Management and Recycling	7
	Sub Total	**38**
Regular Platform Sessions	Inventory Analysis	5
	Impact Assessment	7
	Eco-Efficiency and Indices	7
	Ecodesign / Environmental	5
	Input-Output Analysis	8
	Buildings	6
	Electronic Equipment	6
	Cars & Materials	8
	Infrastructure and Public Services	8
	Agriculture	5
	Material Flow Analysis	8
	Life Cycle Management	6
	Database and Software	8
	Sustainable Consumption	8
	EcoMaterial	11
	Sub Total	**106**
Poster Session		94
	Total	**240**

jects, which was the first trial since the Conference was first held 12 years ago. These sessions had 20 minutes of overall discussions at the end, where future research themes were mainly discussed among people who were interested in the topic of each special session. This overall discussion seemed to be well received by its attendants.

As associated events, the following 3 workshops were organized in connection with the 7th ICEB. The first is The 5th

AIST Workshop on LCA for APEC Member Economies 'LCA of Global Supply Chains from production to end of life management' (Nov. 14–15). The second is The 2nd International Workshop of NEDO Grant Project 'International Development and Standardization of Environmental Information Indices of Materials' (Nov. 15). The third is NIES WS on resource consumption (Nov. 17).

The conference report highlights the opening plenary session, at the core of which were keynote lectures by two guest speakers, and the closing plenary session, at the center of which were summaries of the five special sessions.

1 Opening Plenary Session

Ryoichi Yamamoto of the University of Tokyo, the Chairman of the International Advisory Board, opened the 7th ICEB by noting that EcoBalance methodologies, including LCA, are becoming more important to promote eco-innovations over society as a whole. Following the opening remarks, there were keynote lectures by two guest speakers in the opening session chaired by Yuichi Moriguchi.

1.1 Plenary Lecture 1

Alan AtKisson, CEO of the AtKisson Group, which is a small global consulting firm that focuses on sustainable development, highlighted closing the gap between knowledge created by researchers and knowledge required for decision-making.

Usually, there is a great distance between sustainability-oriented research and decision-making processes. It is therefore critically important to reduce the distance, in other words, to improve the speed and clarity of research signals being sent to decision-makers. In order to improve the transmission of sustainability knowledge, a social model that describes the process of getting research-generated knowledge into decision-making and action, called the ' Signal Path Approach,' is beneficial. The process consists of 10 stages as shown in **Fig. 1**. After a phenomenon occurs (Stage 1), data is collected (Stage 3) and analyzed to find critical patterns and dynamics using analysis methods such as Life Cycle Analysis and System Dynamics (Stage 4). The results are translated into 'signals' that non-specialists can understand (Stage 5), and the signals are transmitted via various media (Stage 6). Then, the signal is filtered and assigned a value according to already-existing beliefs and values regarding the world (Stage 7 and 8). Finally, the signal arrives at decision-makers.

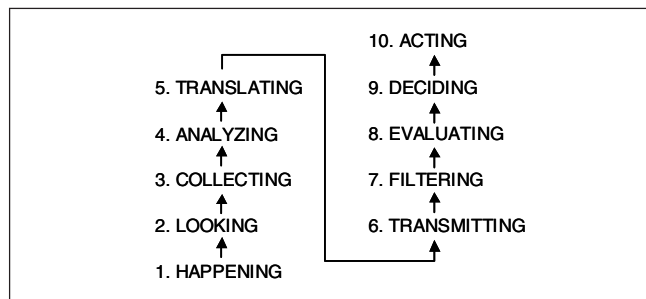Filtering and Evaluating are key stages for improving the chances that knowledge-creation will survive the journey and ultimately inform action. We often filter out the signals or evaluate them as not relevant to our decision, precisely because we know that if we let them in, they might require us to change a fundamental belief or core value. This is a barrier that obstructs the process of turning sustainability knowledge into sustainability action. Thus, the most effective available strategy for accelerating the process is the establishment of a fundamental, guiding ethic of sustainability. AtKisson concluded his speech by challenging the participants to consider how they can contribute to increasing the ethical commitment to creating sustainable communities, organizations, technologies, and societies.

1.2 Plenary Lecture 2

Hisashi Ishitani of Keio University talked about the importance of comprehensive system approaches and LCA roles.

Climate change policy strongly requires identifying the best energy technology systems. The long-term and worldwide influences of various energy technologies on society and the environment must be evaluated in order to make policy on future energy systems. Since such an evaluation requires considering complex relationships among various factors, a comprehensive system approach is essential. However, a comprehensive system approach needs complicated and large-scale models, including a wide range of phenomena in the real world. Due to the complexity, it is very difficult to accurately describe the system structure and to get reliable information. Conversely, LCA, which is a simple system approach, is useful to obtain information required for decision-making. LCA can give practical information based on a well-established methodology and procedure.

In JHFC (Japan Hydrogen and Fuel Cell) Project, Well to Wheel (WtW), analysis has been performed for exploring a car with high energy efficiency from a life cycle perspective. The JHFC WtW analysis, comparing life cycle energy efficiency and CO_2 emission for different types of cars, demonstrates the best fuel path from 'Well' to 'Wheel'. The results can contribute to the development and selection of car-related technologies. However, it should be noted that primary energy transformed to car fuels can also be applied to other objectives, e.g., power generation or heating. For example, biomass can be used both for power generation and car fuels. The use of biomass for power generation may be better than for car fuels from a viewpoint of the overall energy efficiency over society. This example implies the comprehensive evaluation, taking all the alternative and/or competitive energy technologies into consideration is required to identify a real optimum energy system.

Ishitani concluded his speech by noting that the appropriate setting of system boundaries is important: not too complicated to use practically, but not too simple to explore consistent results.

2 Closing Plenary Session

Hiroki Hondo, the chairman of the program committee for the 7th ICEB, chaired the closing plenary session, which consisted of three parts: a Poster Prize ceremony, summaries of the five special sessions, and the final remarks.


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                    10. ACTING

5. TRANSLATING     9. DECIDING
      ↑                 ↑
4. ANALYZING       8. EVALUATING
      ↑                 ↑
3. COLLECTING      7. FILTERING
      ↑                 ↑
2. LOOKING         6. TRANSMITTING
      ↑                 ↑
1. HAPPENING
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Fig. 1: 10 Stages in The Signal Path Approach

2.1 Poster Awards

The poster session was held over two hours on the second day, where a total of 94 posters were presented. Among them, the 3 best posters were selected by a vote of members of the Poster Awards committee based on the content, explanation and presentation. Poster Awards were presented to:

– Timothy Grant, Lisa Opray, Ashok Sharma, Andrew Grant and Francis Pamminger, 'Life Cycle Costing and Life Cycle Assessment of water and waste water alternative approaches,'
– Naohiro Tanaka and Masahiko Hirao, 'Comparative Study on Life Cycle Assessment of Plant-derived and Petrochemical Plastics,'
– Hirotake Osuga, Kazuyo Yokoyama, Kenichi Nakajima and Tetsuya Nagasaka, 'Material Flow Analysis of Aluminum Dross and Environmental Assessment for Its Treatment.'

2.2 Summaries of the Five Special Sessions

Session 1) Energy and Sustainability

A total of 12 presentations in the session were largely categorized into 2 types of studies: Integrated Assessment (IA) and Technology Assessment (TA). The following 4 presentations were characterized as the IA study. Rainer Friedrich provided environmental externalities: ExternE approach. Roberto Dones explained Multi-Criteria Decision Analysis addressing 3 components of sustainability (i.e., economy, environment, and social) with case studies in Germany and China. Hiroshi Yagita introduced a global energy-material-economy optimization model considering hidden flows of resources (i.e., total material requirement, ecological rucksack). Yoshiyuki Shimoda showed city-scale residential, end-use simulation with all dwelling energy-efficient typologies. The following 8 presentations were categorized as the TA study. Koji Tokimatsu provided a review of Energy Analysis and Energy-related LCA in Japan. Yasuko Baba explained the results of Well-to-Wheel analysis of fuel cell vehicles in Japan Hydrogen and Fuel Cell project, which Ishitani referred to in his plenary lecture. Albert Chan presented sustainability assessment of oil sands development in Canada using a systems modeling approach. 3 bio-related studies were presented; Martin Baitz addressed competitiveness of biofuels compared to conventional fossil fuels, Kiyoshi Dowaki demonstrated the LCA results of an advanced biomass process of tri-generation, and Yoji Kunimitsu performed economic evaluation of rice husk power generation in Thailand using IOA. Apart from the above 6 presentations addressing environmental and economic aspects, there were 2 presentations focusing on social aspects; Hiroki Hondo concentrated on the change of people's attitude, norms, and behavior associated with installing residential PV systems, and Rita Schenck elucidated the social mechanisms in decision-making on introducing renewable resources.

In the overall discussion, proposed were the following 3 future research issues for sustainability assessment of energy systems: 1) modeling for integrated assessment such as macroeconomic models with LCA-based externalities, 2) the development of integrated and/or specified indicators (e.g., biodiversity loss), and 3) the extension of assessment focusing on social aspects and the outreach to stakeholders and decision-makers.

Session 2) Eco-Industrial Development

A varied range of research and practices were presented in the session from different states and cultures. First of all, the steel industry in Brazil and its symbiotic practices to enhance the regional circulation and substitution for renewable resources were reported, and public-private collaboration was discussed. Kitakyushu research for an environmental accounting system for evaluating eco-towns and scenario evaluation was presented, and the methodology applicability for traditional industries was discussed. In the invited speeches, Rene van Berkel from Australia showed how an increase of eco material and environmental effects and drivers are discussed in a synergy combination model for Australian Industrial Symbiosis practices. The other invitee, Yong Geng from China, presented Chinese Circular Economy with initiatives and future plans. Evolutionary stages of Eco-Industrial Developments in Kawasaki Eco-town and decision support system for integrative evaluation of synergy among industries and urban sectors followed. Finally, governmentally driven industrial symbiosis activities among small and middle scale enterprises in Sustainable Industrial Area, Macrolotto, Italy were presented.

Discussion with floor participants was made intensively, and their focus is shown as follows:

1) Drivers for Eco-Industrial Developments. Governmental leadership based on the sophisticated, societal maturity for environmental concerns in the EU is significant, while business drivers are also very crucial for driving Eco industrial development and actions particularly in developing economies such as Chinese eco-industrial zones, which was also a key factor for sustainable European industrial symbiosis projects.

2) Scientific tools and System Approach for Expanding Practice. Water and energy circulation should be contemplated for integrative evaluation as well as multi-scale or multi-sectoral assessment. Extensive roles for analytical systems and evaluation methods were discussed such as GIS, LCA, an accounting system based on the identification of Eco-Industrial Developments in different cultures, industrialization stages and environmental resources.

3) Advertisement and Citizen Participation. Advertisement and Consensus Making with Citizen Groups is inevitable for sustainable eco-industrial developments. Information sharing, understandable indicators, and a communication system were suggested as important segments for eco-industrial developments.

Concluding discussions dealing with the expected contribution from expert groups in Eco-balance to Eco-Industrial Developments were addressed as follows:

1) Scientific analysis and evaluation system for providing symbiotic policy and business alternatives based on objective data and information,
2) Analytical tools to contemplate evaluating the economical and environmental improvements of eco-technologies and policy programs considering local socio-economic and environmental characteristics,
3) Understandable tools for providing information, data, and evaluation for sustainable decision-makers, such as business managers, local governments, and citizens' groups to increase public acceptance and social drivers for sustainable direction.

Session 3) Eco-Efficiency for Information and Communication Technology

There were a total of 7 presentations. Arpad Horvath gave an overview of trends and themes over 14 years of ICT research in the United States, and ideas for future work. Yasunari Matsuno explained the recent activities related to the development of eco-efficiency evaluation guidelines for ICT in Japan, and expressed the need for quantification of service value. Next, presentations of case studies were given by Japanese industries, the NTT, Fujitsu, and Hitachi groups. Takafumi Hashitani introduced comparative LCA case studies for 67 ICT solutions, taking into account resources and energy consumption by humans/commodity transportation, and office, warehouse, and ICT equipment, and network data communication. Masayuki Tsuda introduced the development of a new social sustainability index, the Gross Social Feel-good Index, evaluating the contribution of ICT to sustainable society. These presentations indicated that intensive efforts have been made by Japanese industries in evaluating environmental impacts and benefits of ICT.

The following were discussed for the future topics: 1) How do we use and interpret the results of ICT products and services? What are the policy actions to take?; 2) While some people insist that market prices represent the value of services, there is still the question as to whether it is appropriate to incorporate only economic value in the assessment indicator; 3) We need to assess benefits of ICT over time, like happiness, recognizing that we ourselves change over time.

It was also pointed out that a more uniform boundary setting and common data for ICT, such as an environmental impact of network infrastructure, would be needed. In addition, it was suggested that we should assess not just energy and GHGs, but other environmental impacts such as human toxicity, aquatic toxicity, etc.

Session 4) Flow Management for Process Innovation and Sustainability

The topic of the session was 'Flow Management for Process Innovation and Sustainability', and focused on Material Flow Cost Accounting (MFCA). MFCA has been introduced to a number of Japanese companies. The MFCA method can give corporate management information to improve Material Efficiency.

We invited Bernd Wagner, Augsburg University, Germany, who developed the basic idea of MFCA. Wagner made a presentation on 'Flow Management in Germany: Focused on MFCA.' In addition, four other presentations were given: 1) Introduction of MFCA idea and methodology with basic company case-study, Nitto Denko, 2) Advanced MFCA, trial integrated with LCA, 3) Advanced MFCA case-study in Canon, MFCA introducing into Supply Chain (Suppliers), 4) Overview of MFCA movements, sponsored by the Japanese Ministry of Economics, Trade and Industry (METI) Projects, managed recently by Japan Management Association Consulting.

The overall discussion focused on three topics. One was on the terminology of MFCA. MFCA uses specialized terms and calculation methods. The second was concerned with the potentials of MFCA to promote Material Efficiency, in companies or in an entire country. For example, governmental policies to promote MFCA would be useful to evaluate social recycling systems or build new ones that allow Material Efficiency to increase. The last topic emphasized environmental aspects within MFCA (example, LCA).

The session developed mainly two tasks for the future. MFCA should introduce more successful case-studies in practice, and also spread the scope of MFCA analysis to R&D, Design, Purchasing and Sales Department in companies and into the Supply Chain. Moreover, it is important for MFCA to include not only cost but also environmental information from companies, from LCA, etc. We must establish a network (people, organizations, regional and international) to exchange opinions and experiences concerning MFCA.

Session 5) Waste Management and Recycling

There were 7 presentations in the session, which were characterized into (1) Environmental assessment on waste management and recycling of municipal solid wastes in Asian cities (4 papers), and (2) Environmental assessment of recycling in industry (3 papers). Jianxin Yang discussed the municipal solid waste flows in three Chinese metropolises (Beijing, Shanghai and Xi'an). Yu Sekine showed that the CO_2 reduction potential of plastic recycling depends on the quality, i.e., composition of plastic wastes. Rokuta Inaba showed that it is important to consider the supply-demand balance of recycled products in order to appropriately evaluate recycling systems. Based on the evaluation of changes in the quality of domestic steel production due to steel scrap export, Yuma Igarashi found that such exports have a significant impact on the Cu level of EAF (Electric Arc Furnace) iron steel products.

In the overall discussion, it was suggested that we should dynamically assess waste generation for the designing of waste management and recycling systems, and the following were pointed out as future topics: (a) DfE (design for environment) for waste management and recycling systems, (b) Consideration of quality of waste materials and supply-demand balance of recycled products, (c) Linkage of MFA and LCA for waste management and recycling, (d) Life cycle costing of waste management and recycling, (e) Estimation of reuse and/or life time extension of products besides recycling.

2.3 Closing Remarks

Yuichi Moriguchi delivered closing remarks at the end of the session. He emphasized that researchers of EcoBalance methodologies have to make a greater effort to draw the attention of potential users of the methodologies in addition to manufacturing industries, and respond to the real needs of society. In addition, he mentioned that it is important to continuously collaborate among experts in different fields related to science and technology for sustainability.

References

[1] Proceedings of the 7th International Conference on EcoBalance (Information on the proceedings can be found at The 7th ICEB web site: <http://www.sntt.or.jp/ecobalance7/2nd/index.html>)